REMARKS

The foregoing amendments are responsive to the August 12, 2004 Office Action. Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and the following remarks.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Response to Request for Information Under 37 C.F.R. § 1.105

The Examiner requested a detailed description of SuperNEC software features up to January 10, 2000, a description of the first edition of SuperNEC that included the LUCIFER method, and a detailed description of the contributions of Kevin Rogan to the *Rockwell* reference cited below and the LUCIFER program.

An information disclosure statement filed herewith includes copies of the User Manuals for SuperNEC. Various portions of the manuals are dated differently, but all are dated after January 10, 2000. Applicant does not know exactly which features described in the manuals existed on January 10, 2000, and which features were added after January 10, 2000. After September 29, 2000, at least portions of the claimed invention were implemented in SuperNEC based on information provided by Applicant to Poynting Software after September 29, 2000.

To the best of Applicant's knowledge, the LUCIFER method has never been incorporated into SuperNEC.

With respect to the work reported in *Rockwell*, Applicant developed all of the methods and theory reported in *Rockwell*. Applicant developed the LUSIFER algorithm and explained it to Kevin Rogovin who was then given the assignment of writing a computer program that used the algorithm. He wrote such a computer program in Fortran 77 and in C++. He also took the algorithm as shown to him by Applicant and re-expressed it in a different mathematical notation. In addition, he took the proof of correctness described to him by Applicant and found a different proof of the correctness of the algorithm. With respect to "*Rockwell*," the only results reported there that were due to Kevin Rogovin were numerical results from the computer program that he wrote and ran based on the algorithms, methods, theory, and instructions provided by Applicant. (Mr. Rogovin received a Ph.D. in mathematics in 2002 and is now Dr. Kevin Rogovin.)

Response to Objection to Provisional Under 35 U.S.C. § 112

The Examiner asserts that there is lack of support in the specification of the Provisional application for the use of the terms Method of Moments (MoM), basis and weighting functions, and far-field disturbances.

With regard to the MoM, the term Method of Moments (MoM) is well known to those skilled in the art as a matrix technique for solving integral equations. Pages 7 through 10 of the provisional application describe the use of one embodiment in connection with the computer program NEC2. It is well known to those skilled in the art that the analysis used by NEC2 is based on the Method of Moments. NEC2 is one of the best known (arguably the best known) computer programs based on the Method of Moments. Pages 7 through 10 of the Provisional Application describe various aspects of NEC2 that result from the fact that NEC2 uses the Method of Moments. In addition, the manuals describing NEC2 are mentioned on Page 7, lines 22, 23, "The NEC2 computer program itself and manuals describing the theory and use are freely available over the internet." Furthermore, the term "Method of Moments" is even part of the title of the program description manual for NEC2, which is, "NUMERICAL ELECTROMAGNETICS CODE (NEC) – METHOD OF MOMENTS PART I: PROGRAM DESCRIPTION – THEORY." Page 11 describes the **Z** matrix as being obtained from the **Z** matrix from NEC2. A person of ordinary skill in the art knows that the NEC2 **Z** matrix is a moment method matrix.

The terms "basis functions," and "weighting functions" are well known to those of ordinary skill in the art. These terms are well known to those of ordinary skill in the art, both in the context of the Method of Moments and in the context of linear algebra. For example, the Provisional Application on Page 6, at line 20, states, "One embodiment is used in connection with the computer program NEC2." Section III of the theory manual for NEC2 describes basis functions on Page 9 on the line before Equation (17) and describes weighting functions on Page 9 on the line before Equation (18).

Moreover, even those with a rudimentary knowledge of the Singular Value Decomposition (SVD)

$$\mathbf{A} = \mathbf{U}\mathbf{D}\mathbf{V}^{\mathbf{h}} \qquad (1)$$

as described on page 9 of the provisional application know that "the columns of **U** whose same-numbered elements *wj* are nonzero are an orthonormal set of basis vectors that span the range;

the columns of **V** whose same-numbered elements *wj* are zero are an orthonormal basis for the nullspace." ("Numerical Recipes," William H. Press, et al., 1986, pp. 54-55). Further, the above equation (1) can be "rewritten to express any matrix A_{ij} as a sum of outer products of columns of **U** and rows of $\mathbf{V}^t$, with the "weighting factors" being the singular values w_j " (*Id.* at 60).

The Provisional Application discloses the physical quantities "sources" and "testers." Claim 1 recites "said basis function corresponding to an original source" and "said weighting functions corresponding to an original tester." Thus, the terms "basis" and "testing" functions are used in a manner consisted with the disclosure in the provisional application and do not add new matter.

Support for the term "far-field disturbances" occurs in the Provisional Application. For example, Page 5, lines 12 and 13, read: "a relatively dense set of disturbances (usually described in a spherical coordinate system) at relatively large distances." Page 5, lines 23-25 read: "Composite sources are found, which apply to the disturbance at the spherical angles and at a relatively large distance. To achieve a relatively large distance, it is often useful to use a limiting form as the disturbance goes infinitely far from its source." One of ordinary skill in the art knows that the term far-field is a standard term of art used to describe the approximate limiting form as a disturbance recedes from its source. Page 6, at line 8 says of the disturbance: "Also, the 'far field' data does not have to be all that far away."

The terms Method of Moments (MoM), basis and weighting functions, and far-field disturbances are fully supported by the provisional application. Applicant requests the Examiner to withdraw the objection to these terms.

Response to Objection to the Specification under MPEP § 310

The Examiner objected to the specification arguing that a statement regarding federally sponsored research and development is required under § MPEP 310.

The subject of this application was neither conceived nor developed under federally sponsored research and development. The U.S. government has no rights in the present invention. A statement under § MPEP 310 would be improper.

Applicant requests the Examiner to withdraw the objection under § MPEP 310.

Response to Requirement for a New Oath or Declaration

The Examiner states that a new oath or declaration is required because an article "Fast Direct Solution of Standard Moment-Method Matrices" by Francis Canning and Kevin Rogovin (hereinafter *Rockwell*) appears to teach the claimed invention and appears to suggest that Mr. Rogovin's name is missing from the declaration.

As described below, *Rockwell* does not teach or suggest the claimed invention. Mr. Rogovin did not participate in the conception of the claimed invention and is not a co-inventor.

Moreover, Mr. Rogovin's contribution to any invention arising out of the article would not rise to the level of co-inventor. Applicant developed all of the methods and theory reported in *Rockwell*. Applicant developed the algorithm and explained it to Kevin Rogovin, who was then given the assignment of writing a computer program that used the algorithm. He wrote such a computer program in Fortran 77 and in C++. The computer program was used to obtain the numerical results reported in *Rockwell*.

Applicant requests the Examiner to withdraw the requirement for a new oath or declaration

Response to Rejection of Claim 12 Under 35 U.S.C. 112

The Examiner rejected Claim 12 as lacking antecedent basis for "basis composite sources." Applicant has amended Claim 12 to correct the antecedent basis for the term "composite sources."

Applicant requests the Examiner to withdraw the objection to Claim 12.

Response to Rejection of Claims 1-33 Under 35 U.S.C. 101

The Examiner rejected Claims 1, 2, 10, 23, 27 and 28 under 35 U.S.C. 101 as being a series of mental steps.

Applicants have amended Claims 1, 2, 10, 23, and 28 to clarify at lest portions of the method are performed by an apparatus.

Claim 27 is an apparatus claim and thus not a series of mental steps.

The Examiner rejected Claims 3-9, 11-22, 24-26 and 29-33 as being dependent on a rejected base claim. The rejections of Claims 3-9, 11-22, 24-26 and 29-33 are traversed by the amendments to Claims 1, 2, 10, 23, and 28.

Applicant asserts that Claims 1-33 are in condition for allowance, and Applicant requests allowance of Claims 1-33

Response to Rejection of Claims 1-33 Under 35 U.S.C. 102(b)

The Examiner rejected Claims 1-33 under 35 US.C. 102(b) as being anticipated by *Rockwell.*

Rockwell teaches using a known prior-art technique of employing a single SVD rank reduction on a rectangular array of data to compress the array. It was known previously that composite sources and composite testers that are created by a single SVD applied to a given rectangular array of data can then be used to compress that same array of data.

The present application teaches that one can use a first rank reduction on a first set of data to obtain composite sources, and a second rank reduction on a second (and different) set of data to obtain composite testers, and then use these separately-computed composite sources and composite testers together to compress a third set of data. The third set of data is not identical to at least one of the first and second sets of data.

For example, the first set of data may be a matrix describing the far-field effect of each source at various angles and the second set of data may be a different matrix describing the reception of each tester from various angles. In this example, the first and second data are obtained separately from physical principles rather than applications of linear algebra and thus, it is not obvious that rank reductions of the first and second matrices could be used to compress a third matrix.

Regarding Claim 1, *Rockwell* does not teach or suggest partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of the basis functions corresponding to an original source, selecting a plurality of spherical angles, calculating a far-field disturbance produced by each of the basis functions in a first group for each of the spherical angles to produce a matrix of transmitted disturbances, reducing a rank of the matrix of transmitted disturbances to yield a second set of basis functions, the second set of basis functions corresponding to composite sources, each of the composite sources comprising a linear combination of one or more of the original basis functions, partitioning a first set of weighting functions into groups, each group corresponding to one of the regions, each weighting function

corresponding to a condition, each of the weighting functions corresponding to an original tester, calculating a far-field disturbance received by each of the testers in a first group for each of the spherical angles to produce a matrix of received disturbances, reducing a rank of the matrix of received disturbances to yield a second set of weighting functions, the second set of weighting functions corresponding to composite testers, each of the composite testers comprising a linear combination of one or more of the original testers, and transforming the system of linear equations to use the composite sources and the composite testers.

Regarding Claim 2, *Rockwell* does not teach or suggest partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to an unknown in a system of equations, each of the basis functions corresponding to an original source, selecting a first plurality of angular directions, calculating a disturbance produced by each of the basis functions in a first group for each of the angular directions to produce a matrix of disturbances, using the matrix of disturbances to compute a second set of basis functions, the second set of basis functions corresponding to composite sources, wherein at least one of the composite sources produces a relatively weak disturbance from a portion of space around the at least one composite source, partitioning a first set of weighting functions into groups, each group corresponding one of the regions, each weighting function corresponding to a condition, each of the weighting functions corresponding to an original tester, calculating a disturbance received by each of the testers in a second plurality of angular directions to produce a matrix of received disturbances, using the matrix of received disturbances to compute a second set of weighting functions, the second set of weighting functions corresponding to composite testers, wherein at least one of the composite testers weakly receives disturbances from a portion of space relative to the at least one composite tester, and transforming at least a portion of the system of equations to use one or more of the composite sources and one or more of the composite testers.

Regarding Claim 3, *Rockwell* does not teach or suggest the method of Claim 2, wherein the matrix of disturbances is a moment method matrix.

Regarding Claim 4, *Rockwell* does not teach or suggest that using the matrix of disturbances from Claim 2 to compute a second set of basis functions comprises reducing a rank of the matrix of disturbances.

Regarding Claim 5, *Rockwell* does not teach or suggest that using the matrix of received disturbances from Claim 2 to compute a second set of weighting functions comprises reducing a rank of the matrix of received disturbances.

Regarding Claim 6, *Rockwell* does not teach or suggest that the disturbance of Claim 2 is at least one of an electromagnetic field, a heat flux, an electric field, a magnetic field, a vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, a strong nuclear force, and a gravity force.

Regarding Claim 7, *Rockwell* does not teach or suggest that first plurality of directions in Claim 2 is substantially the same as the second plurality of directions.

Regarding Claim 8, *Rockwell* does not teach or suggest that the regions of space around the at least one composite source in Claim 2 are far-field regions.

Regarding Claim 9, *Rockwell* does not teach or suggest that the at least a portion of a region around the at least one composite tester in Claim 2 is a far-field region.

Regarding Claim 10, *Rockwell* does not teach or suggest calculating one or more composite sources as a linear combination of one or more basis functions, wherein at least one of the composite sources produces a relatively weak disturbance in a portion of space related to the at least one composite source, calculating one or more composite testers as a linear combination of one or more weighting functions, wherein at least one of the composite testers is affected relatively weakly by disturbances propagating from a portion of space around the at least one composite tester, and transforming at least a portion of a first system of equations based on the basis functions and the weighting functions into a second system of equations based on the composite sources and the composite testers.

Regarding Claim 11, *Rockwell* does not teach or suggest the method of Claim 10, wherein the disturbance is at least one of, an electromagnetic field, a heat flux, an electric field, a magnetic field, vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, strong nuclear force, and a gravity force.

Regarding Claim 12, *Rockwell* does not teach or suggest the method of Claim 10, wherein the composite sources comprise electric currents.

Regarding Claim 13, *Rockwell* does not teach or suggest the method of Claim 10, wherein the composite sources comprise magnetic currents.

Regarding Claim 14, *Rockwell* does not teach or suggest the method of Claim 10, wherein the composite sources comprise acoustic sources.

Regarding Claim 15, *Rockwell* does not teach or suggest the method of Claim 10, wherein the composite sources comprise electromagnetic sources.

Regarding Claim 16, *Rockwell* does not teach or suggest the method of Claim 10, wherein the composite sources comprise thermal sources.

Regarding Claim 17, *Rockwell* does not teach or suggest the method of Claim 10, wherein each of the composite sources corresponds to a region.

Regarding Claim 18, *Rockwell* does not teach or suggest the method of Claim 10, wherein the second system of equations is described by a sparse block diagonal matrix.

Regarding Claim 19, *Rockwell* does not teach or suggest the method of Claim 18, further comprising the step of reordering the sparse block diagonal matrix to shift relatively larger entries in the matrix towards a desired corner of the matrix.

Regarding Claim 20, *Rockwell* does not teach or suggest the method of Claim 10, further comprising the step of solving the second system of equations.

Regarding Claim 21, *Rockwell* does not teach or suggest the method of Claim 10, further comprising the step of solving the second system of equations to produce a first solution vector, the first solution vector expressed in terms of the composite testers.

Regarding Claim 22, *Rockwell* does not teach or suggest the method of Claim 21, further comprising the step of transforming the first solution vector into a second solution vector, the second solution vector expressed in terms of the weighting functions.

Regarding Claim 23, *Rockwell* does not teach or suggest calculating at least one composite source, the composite source representing energy sources, calculating at least one composite tester, and transforming at least a portion of a first system of linear equations into a second system of linear equations based at least on the at least one composite source and the at least one composite tester.

Regarding Claim 24, *Rockwell* does not teach or suggest the method of Claim 23, wherein the at least one composite source represents a linear combination of one or more energy sources such that the at least one composite source radiates relatively little energy into a portion of angular region disposed about the at least one source.

Regarding Claim 25, *Rockwell* does not teach or suggest the method of Claim 23, wherein the at least one composite tester is affected relatively weakly by energy propagating from a portion of space around the at least one composite tester.

Regarding Claim 26, *Rockwell* does not teach or suggest the method of Claim 23, wherein the second system of linear equations is represented by a block sparse matrix.

Regarding Claim 27, *Rockwell* does not teach or suggest the means for calculating at least one composite source, means for calculating at least one composite tester, and means for transforming at least a portion of a first system of equations into a second system of equations based at least on the at least one composite source and the at least one composite tester.

Regarding Claim 28, *Rockwell* does not teach or suggest calculating one or more composite sources as a combination of one or more basis functions, wherein at least one of the composite sources produces a relatively weak product in a portion of space, calculating one or more composite testers as a combination of one or more weighting functions, wherein at least one of the composite testers interacts relatively weakly with the at least one composite tester, and transforming at least a portion of a first array of interaction data based on the basis functions and the weighting functions into a second array of interaction data based on the composite sources and the composite testers.

Regarding Claim 29, *Rockwell* does not teach or suggest the method of Claim 28, wherein the disturbance is at least one of, an electromagnetic field, a heat flux, an electric field, a magnetic field, vector potential, a pressure, a sound wave, a particle flux, a weak nuclear force, strong nuclear force, a gravity force, and an image element.

Regarding Claim 30, *Rockwell* does not teach or suggest the method of Claim 28, wherein each of the composite sources corresponds to a region.

Regarding Claim 31, *Rockwell* does not teach or suggest the method of Claim 28, wherein the second array of interaction data is described by a sparse block diagonal matrix.

Regarding Claim 32, *Rockwell* does not teach or suggest the method of Claim 28, further comprising the step of using the second array of interaction data to compute a first solution vector, the first solution vector expressed in terms of the composite testers.

Regarding Claim 33, *Rockwell* does not teach or suggest the method of Claim 32, further comprising the step of transforming the first solution vector into a second solution vector, the second solution vector expressed in terms of the weighting functions.

Accordingly, Applicant asserts that Claims 1-33 are in condition for allowance, and Applicant requests allowance of Claims 1-33.

Summary

Applicants respectfully assert that Claims 1-33 are in condition for allowance, and Applicants request allowance of Claims 1-33. If there are any remaining issues that can be resolved by a telephone conference, the Examiner is invited to call the undersigned attorney at (949) 721-6305 or at the number listed below.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: Nov 12, 2004

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